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# Field evaluation of extracts of four selected plants for the Management of *Maruca vitrata* Fab on Cowpea *Vigna unguiculata* L. Walp.

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**ABSTRACT**
The insecticidal effectiveness of petroleum ether seed extracts of four plants namely *Azadiratcha indica*, A.Juss, *Piper guineense* Schum and Thonn ,*Annona muricata* L. and *Jatropha curcas* L. were assessed in the field for the management of legume pod borer (*Maruca vitrata* Fab) on cowpea during the rainy season of year 2014. The experiment was laid out in a Randomized Complete Block Design (RCBD) in six replications. The extracts were applied at the rate of 10ml/1l of water at weekly intervals for twelve weeks and compared with Lambdacyhalothrin at 5ml/10l of water as a standard check and untreated control. The results showed that all the treatments significantly ($p < 0.05$) reduced the population of legume pod borer compared to control. *Annona muricata* followed by *Piper guineense* significantly ($p<0.05$) reduced the population of legume pod borer compared to other extracts. The percentage reduction of *M. vitrata* population ranged from 37% - 80% compared to control. Consequently, the number of damaged pods was significantly ($p<0.05$) lower on plots treated with *A. muricata,* followed by *P. guineense*. Cowpea yield was significantly ($p<0.05$) higher in plots treated with *A. muricata* and *Piper guinense* compared to other extracts. The four extracts evaluated were significantly ($P<0.05$) more effective than Lambdacyhalothrin in reducing *M. vitrata* population on cowpea in the field. Therefore, the utility of these plant extracts in pest management should be fully adopted by farmer since they are widely available in Nigeria, devoid of human or environmental hazards, ease in application and relatively cheap
**Key words**: Cowpea. Plant extracts, *Maruca vitrata*, Pest management

## INTRODUCTION

Cowpea *Vigna unguiculata* (L.) walp Fabaceae is a very important food crop in the tropics and it accounts for about 60% of human protein intake in Nigeria [1]. They are widely grown throughout the tropics, especially in the savannah zone of the world[2].. Small holder farmers who produce the bulk of cowpea grains consumed in the country record low yield (<2 00 kg/ha) due to series of pest complex associated with cowpea in the field [1].

The major cowpea insect pest complex consists of the flower bud thrips *Megalurothrips sjostedti* Trybom (Thripidae), legume pod borer *Maruca vitrata* Fab.(Crambidae), and several species of pod sucking bugs of which *Clavigralla tomentosicollis* Stal.(Coreidae)is dominant, and aphids, mostly *Aphis craccivora* Koch(Aphididae) [2]. Among these insect pests, *M. vitrata* alone causes 20-80 % yield losses in the field in different parts of Africa [3].

The use of synthetic chemicals in controlling these pests is common and effective [4]. However, these chemicals are known to have detrimental effects on humans and the environment [5], hence their use is being discouraged. In order to replace these chemicals with alternatives, many plant products have been screened for their insecticidal and antimicrobial properties [6];[7].

Neem, *Azadirachta indica* A.Juss. has evoked a great deal of interest because of its bio-efficacy and bio-degradability. Among the plants possessing environmental-friendly properties, neem has proved to be of very important quality on account of its insecticidal properties against a number of insect pests. Similarly, extracts of *Piper. guineense* Schum & Thonn. and *Lippia adoensis* Hoschst .Olaifa[8] have all been found effective against a number of insect pests of cultivated crops. Also, *Annona muricata* seed and leaf extracts have been reported to be effective against field insect pests of vegetables [9].

The present study was aimed at investigating the insecticidal efficacy of extracts from four plants grown in Nigeria namely *A. indica*, *P. guineense,, A. muricata* L. and *J. curcas* L. to protect cowpea against *M. vitrata* insect pests in the field

## MATERIALS AND METHODS

The experiment was conducted at teaching and research farm of the Federal College of Forestry Ibadan during the rainy season of year 2014. The site is located on latitude 7.9º N and longitude 3.5º

E in rain forest zone of south western Nigeria. The experimental plot of 20 x 10m was manually cleared and after two weeks beds of 1mx1m were constructed leaving 1m alley, thus giving a total of 24 beds in the whole layout. Cured poultry manure was applied at rate of 2.5t/ha as a basal treatment. Cowpea seeds were sown at the spacing of 50cm x 50m at planting rate of 2 seeds per hole. The experimental layout was a Randomized Block Design (RBD) consisting of six treatments (four plant extracts, a synthetic insecticide check (Lambdacyhalothrin) and an untreated check). Each treatment was replicated six times.

Dried fruits of West African black pepper (*P. guineense)* were purchased from local market. The ripe fruits of *A. indica* were picked from the ground around the mother plant; they were soaked in water for 24hours and were later macerated with hand to extract the seeds. The extracted seeds were air-dried for two weeks. Similarly, the mature fruits of *Jatropha curcas* and *Annona muricata* were harvested and seeds were extracted and air - dried for two weeks. These Samples were oven- dried at $60^0$C for 12 hours and later ground to fine powder. Two hundred grams (200g) of powdered samples were weighed and separately placed into a seed extraction chamber. Two hundred and fifty milliliter (250ml) of petroleum ether was added to each of the samples in a flask. The extraction was done for 6hours and later the petroleum ether was distilled off from the flask using quick fit pressure equalizing funnels.

Application of treatments commenced seven weeks after planting (at initiation of flowering) at weekly intervals for twelve weeks. The extracts were applied at the rate of 10ml/l of water and synthetic insecticides (Lambdacyhalothrin) at 5ml/10l of water. 2.5ml of liquid soap was added to the extract solution during preparation to enhance miscibility of extracts with water and adhesion on the leaves. Farm cultural practices were maintained. Weeding was done manually at three weeks intervals to ensure clean plots.

*Maruca vitrata* larvae were sampled before each spraying for 12 weeks beginning at flower bud initiation by removing 5 flowers per sub plot and placing them in vials containing 30% alcohol. These were taken to the laboratory and dissected the next day. The insects found these samples were counted and recorded. Pod damage (shriveling, twisting, stunting, constriction) was assessed by examining 5 pods randomly selected per plant on 5 plants per sub plot. Each plot was harvested and drie. Dry weights of the cowpea pods were recorded from each plot after drying for two weeks.

Data collected were subjected to Analysis of variance (ANOVA) and significant means were separated using Duncan Multiple Rang Test (DMRT) at 5% level of significance.

**Table1. Effects of treatments on the population of *Maruca vitrata* on cowpea**

| | Weeks | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** |
| **Treatment** | | | | | | | | | | | | |
| ***A.muricata*** | 1.75c | 0.75c | 3.00b | 3.00c | 1.50 b | 1.00c | 2.00c | 0.50 b | 3.00b | 2.50d | 3.25c | 2.25c |
| ***A. indica*** | 2.75b c | 2.00bc | 3.75b | 3.50c | 1.50 b | 1.50c | 3.00b c | 2.50 b | 5.25b | 4.25cd | 5.00bc | 4.00bc |
| ***P.guineense*** | 1.75c | 1.50bc | 3.25b | 2.50c | 0.75 b | 1.00c | 2.50b c | 1.50 b | 4.00b | 3.50cd | 4.75bc | 3.75bc |
| ***J. curcas*** | 4.00b | 4.50bc | 4.00b | 3.25c | 2.00 b | 2.00b c | 4.00b c | 2.25 b | 6.50a b | 6.00bc | 5.50bc | 5.25b |
| **Ldh** | 3.50b c | 6.50b | 5.25b | 7.75b | 6.00a | 3.50b | 5.00b | 3.25 b | 6.50a b | 8.50b | 8.00b | 10.25 a |
| **Control** | 6.25a | 13.50 a | 10.25 a | 11.75 a | 8.75a | 6.00a | 8.25a | 8.50a | 9.75a | 12.75 a | 15.50 a | 11.50 a |
| **Sig.level** | ** | ** | ** | ** | ** | ** | ** | ** | * | ** | ** | ** |

Means followed by the same letter within the column are not significantly different at the 5% level by Duncan's Multiple Range Test(DMRT) ;** Significant at 1% level; Ns= Not significant; Ldh- Lambdacyhalothrin

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**Table 2. Effects of treatments on the reduction of** M. vitrata **Population**

| Treatment | Mean population | Percentage (%)population compared to control | Percentage (%) reduction of population compared to control |
|---|---|---|---|
| ***A.muricata*** | 2.25e | 19.96e | 80.04a |
| ***A. indica*** | 4.42c | 42.21c | 57.79c |
| ***P.guineense*** | 2.80de | 26.74de | 73.26b |
| ***J. curcas*** | 4.28cd | 40.87cd | 59.13cd |
| **Ldh** | 6.63b | 63.32b | 36.68de |
| **Control** | 10.47a | 100a | 0e |

Means followed by the same letter within the column are not significantly different at the 5% level by Duncan's Multiple Range Test(DMRT); Ldh- Lambdacyhalothrin

**Table. 3 : Effects of treatments on the cowpea pod damage .**

| | Weeks | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| **Treatments** | | | | | | | | | | | | |
| ***A. muricata*** | 0.75b | 0.50c | 0.50c | 0.50c | 1.00b | 0.50c | 0.75b | 0.75b | 1.00b | 1.00c | 1.50d | 1.00c |
| ***A. indica*** | 1.75b | 1.00c | 1.25bc | 1.25bc | 1.50b | 1.25bc | 1.25b | 1.50ab | 2.25ab | 2.00bc | 2.50cd | 2.00bc |
| ***P. guineense*** | 1.00b | 0.75c | 0.75bc | 1.00bc | 1.25b | 0.75c | 0.75b | 1.00b | 1.75ab | 1.50bc | 2.25cd | 1.75bc |
| ***J. curcas*** | 2.25ab | 1.25bc | 1.50bc | 1.50bc | 1.75ab | 1.25bc | 1.50b | 1.75ab | 2.75ab | 2.75bc | 3.25c | 2.50ab |
| **Ldh** | 2.50ab | 3.00ab | 2.25b | 2.50ab | 2.25ab | 2.25ab | 2.25b | 2.25ab | 2.75ab | 4.00b | 4.75b | 3.25ab |
| **Control** | 3.75a | 3.75a | 4.00a | 3.50a | 4.00a | 2.75a | 4.25a | 3.25a | 4.00a | 7.00a | 7.50a | 4.50a |
| **Sig.level** | * | ** | ** | * | NS | * | * | NS | NS | ** | ** | * |

Means followed by the same letter within the column are not significantly different at the 5% level by Duncan's Multiple Range Test (DMRT); ** Significant at 1% level ; * Significant at 5% level; Ns= Not significant, Ldh= Lambdacyhalothrin

**Table.4 Effects of treatments on the dry weight of cowpea pod**

| | Weeks | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| **Treatment** | | | | | | | | | | | | |
| ***A. muricata*** | 175.0a | 150.0ab | 162.5a | 157.5a | 175.0a | 157.5a | 212.5a | 175.0a | 162.5a | 157.5a | 225.0a | 187.5a |
| ***A.indica*** | 127.5c | 135.0ab | 125.0a | 117.5a | 155.0a | 117.5a | 110.0b | 155.0a | 160.0a | 140.0a | 187.5a | 125.0b |
| ***P. guineense*** | 157.5ab | 167.5a | 142.5a | 155.0a | 170.0a | 155.5a | 192.5a | 170.0a | 162.5a | 145.0a | 200.0a | 187.5a |
| **J. curcas** | 142.5ab | 130.0ab | 130.0a | 125.0a | 165.0a | 125.0a | 105.0b | 165.0a | 157.5a | 110.0a | 122.5b | 105.0b |
| **Ldh** | 122.5bc | 120.0b | 92.50a | 140.0a | 125.0a | 140.0a | 80.0b | 125.0a | 117.5a | 102.50a | 95.0b | 90.0b |
| **Control** | 105.0c | 75.00c | 87.50a | 115.0a | 105.0a | 115.0a | 70.0b | 105.0a | 97.5a | 87.50a | 90.0b | 80.0b |
| **Sig.level** | * | ** | NS | NS | NS | NS | ** | NS | NS | NS | ** | ** |

Means followed by the same letter within the column are not significantly different at the 5% level by Duncan's Multiple Range Test( DMRT); ** Significant at 1% level ; *= Significant at 5% level; Ns= Not significant. , Ldh= Lambdacyhalothrin

**RESULTS**

The results showed that all the extracts significantly ($P < 0.05$) reduced the number of legume pod borer (*M. vitrata*) compared with the untreated control during 2014 cropping season (Table 1). However, the extracts of *A. muricata* gave better control of *M. vitrata* than the other extracts. The reduction. in *M. vitata* population by the extracts and Lamdacyhalothrin ranged from 37- 80 % compared to control (Table 2). *A muricata* extracts was the most effective in reducing *M. vitrata* (80%) followed by *P. guineense*.(73.3% ) while Lamdacyhalothrin was the least (37 %)

Similarly, plots treated with *A. muricata* had the least number of cowpea pod damage followed by the plots treated with *P. guineense* ( Table 3). Plots treated by these two extracts also gave higher grain yields than those of *A. indica* and *J. curcas*. The untreated check gave the lowest yield during the study, although, the plots treated with synthetic insecticide (Lambdacyhalothrin) had higher pod damage and lower pod yield than the extracts used and was thus less active than plant extract treatments (Table 4).

**DISCUSSON**

The results established the potential of the four plant extracts tested to control *M. vitrata* on cowpea plants. The mode of action of these extracts in controlling the target pests could be contact activity for the extracts of *P. guineense*, both contact and antifeedant action for *A. muticata* , A. indica and *J. curcas*. This assumption corroborate the earlier report by Oparaeke[ 1] that visual observations after direct spraying against *C. tomentosicollis* and *Maruca* larvae on cowpea plants indicated that *P. guineense* extract first had a 'hallucination' effect on these pests and then caused their death within 10–15 min of contact with the extracts .

Similarly, Jaramilloa [10] reported that *A. muricata* exhibit significant anti-feedant,, pesticidal, anti-cancerous, anti-tumorous and anti-viral properties . The pest populations were reduced after the fourth week of treatment, suggesting that the extracts may be slow to act; hence the effect could not be noticed after the first three weeks of spraying. Past studies on the insecticidal activity of plant extracts were mostly screen-house trials using neem, African nutmeg, *P. guineense* and garlic products ([8];[11] and [12]). Jackai [11] reported that both aqueous extracts and powders of neem seed and kernel impeded with the development of *M. vitrata* and *Clavigralla tomentosicollis).*The efficacy of *Annona muricata* extract was higher than other extracts used including Lambdacyhalothrin for the protecting cowpea against *M. vitata* .The result support the findings of Padma [13] which showed that *Annona muricata* based product were more effective than synthetic insecticides in the control of different order of insect pest. Riser [14] also confirmed the potential of products from *Annona muricata* plant extracts for the control of field insect pests of cowpea.

The bio-activity of *Annona muricata* has been attributed to various chemicals compounds which include Annonaceous acetogins, Muri-catenol, Annomuricatin, Javoricin, montanacin, montecristin, coronin,donhexocin numbering over 50 which prevents development of insect pests [10]. Golob [15] have shown that P*. guineense* powder, oil, and hexane and acetone extracts are effective in causing mortality and reducing oviposition of various insects when applied to grains and crops such as maize or cowpea.

Similarly, Ugwu [16] also reported that *A. indica* and *P. guineense* extracts demonstrated great potential to control major insect pests of okra. The insecticidal properties of *P. quineense* is Piperine which is the main amide active in *Piper guineense* [17].

*Azadirachta indica* has a pesticidal properties, since it has so many different effects in pest, it act as a broad spectrum repellent, insect regulator(It causes deformities in insects' offspring)and insect poison, it act as an antifeedant [18]. Salmond and Abdullah[19], reported *Jatropha curcas* possess insecticide or antifeedant properties that affect insects of various families.

The plant extracts were observed to be more effective than synthetic chemical in this study. This confirmed the report of Basedow[20] which stated that *A. indica* -based products were more effective than synthetic insecticides for the control of aphids and white flies. Similarly, Ojo and Ugwu [21] reported that *A. indica* seed extract was more effective than cypermethrin synthetic insecticides in controlling the insect pests of *Adansonia digitata* seedling in the field.

**CONCLUSION**

Extracts from *A.muricata, P .guineense , A. indica* and *J. curcas* were found to be very effective in controlling *M. vitrata* on cowpea. *Anona muricata*

extract was the most effective among other extracts for the control of *M. vitrata* .The extracts at 10ml/1L were more efficacious than Lamdacyhalothrin at 5ml/10L in controlling *M. vitrata* on cowpea. These plants are widely available, cheap, and easy to extract in crude forms, consequently, farmers should adopt its use for the management of insect pests in order to curtail human and environmental hazards associated with the use of synthetic insecticides and to reduce cost of purchase.

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